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NATIONAL DAM SAFETY PROGRAM. COLEMAN FALLS DAM (VA-00903), UPPE--ETC(U)
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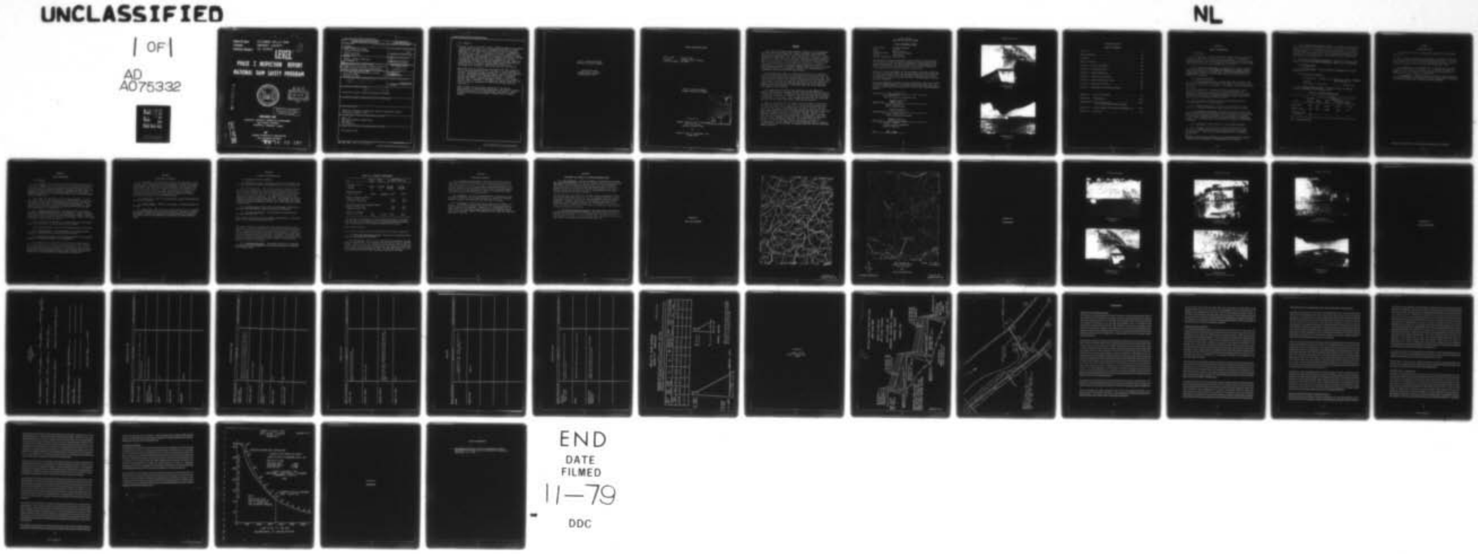

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Name Of Dam: COLEMAN FALLS DAM
Location: AMHERST COUNTY
Inventory Number: VA. 00903

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED FOR

NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

BY

DEWARD M. MARTIN & ASSOCIATES
WILLIAMSBURG, VIRGINIA

AUGUST, 1979

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER VA 00903	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report National Dam Safety Program COLEMAN FALLS DAM Amherst County, VA		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) DEWARD M. MARTIN & ASSOCIATES WILLIAMSBURG, VA		8. CONTRACT OR GRANT NUMBER(s) 15 (DM-DACW 65-78-D-0015)
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10 Paul /Seiler

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Dam Safety
Dam Inspection

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

(See reverse side)

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

COLEMAN FALLS DAM
AMHERST COUNTY, VIRGINIA
INVENTORY NO. 05918

UPPER JAMES RIVER BASIN

Name of Dam: Coleman Falls
Location: Amherst County, Virginia
Inventory Number: VA 00903

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared for

NORFOLK DISTRICT CORPS OF ENGINEERS
803 Front Street
Norfolk, Virginia 23510

by

Deward M. Martin & Associates, Inc.
August 1979

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF DAM

Name of Dam:	Coleman Falls Dam
State:	Virginia
County:	Amherst County
USGS Quad Sheet:	Big Island, Virginia
Stream:	James River
Date of Inspection:	July 12, 1979

The Coleman Falls Dam is a masonry structure about 555 feet long and 36 feet high. The dam is owned and operated by Owens Illinois, Inc., Big Island, Virginia. The dam is classified as intermediate in size with a significant hazard classification. The spillway consists of a masonry weir with a crest elevation of 589.0 m.s.l.

Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the Spillway Design Flood is the 1/2 PMF. The spillway will pass 14% of the PMF and the Spillway Design Flood (1/2 PMF) will overtop the dam by 19.8 feet. The spillway is therefore adjudged inadequate.

The visual inspection revealed no major deficiencies which would require immediate remedial measures. The seepage and missing rocks that were noted in the dam should be monitored as a part of the normal maintenance program.

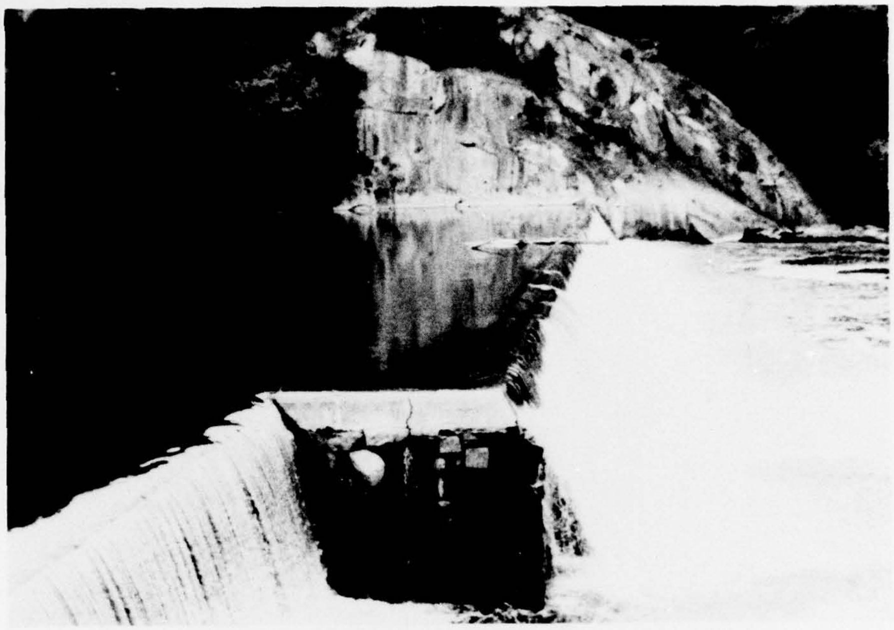
Prepared By: Paul Seiler
PAUL SEILER, P.E.
Deward M. Martin & Associates, Inc.

Submitted By: Original signed by JAMES A. WALSH
JAMES A. WALSH, P.E.
Chief, Design Branch

Recommended By: Original signed by: Carl S. Anderson, Jr.
for JACK G. STARR, P.E.
Chief, Engineering Division

Approved By: Original signed by: LTC Leonard C. Gregor
for DOUGLAS L. HALLER
Colonel, Corps of Engineers
District Engineer

Date SEP 27 1979



PHOTOGRAPH NO. 1
Overview

PHOTOGRAPH NO. 2
Front View

COLEMAN FALLS DAM

TABLE OF CONTENTS

SECTION 1

PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 August 1972 authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspection of dams through the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (Appendix V, Reference 1). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Coleman Falls Dam is a masonry dam about 555 feet long and 36 feet high.* The crest of the dam is at elevation 605.0 feet m.s.l. The width of the spillway crest is estimated to be 3 feet.

The spillway consists of a masonry weir 463 feet long with a crest elevation of 589.0 feet. Located at the right abutment are the remains of a turbine room which is no longer used. Water is entering the turbine pits through the headgate openings, however, there is no apparent main deterioration of the structure.

1.2.2 Location: The dam is located on the James River four miles downstream of Big Island, Virginia.

1.2.3 Size Classification: The dam is classified as an intermediate size structure because of storage capacity (6300 acre-feet).

1.2.4 Hazard Classification: The dam is located in a rural area and is therefore given a significant hazard classification in accordance with guidelines contained in Section 2.1.2 of Reference 1, Appendix V. The hazard classificaiton used to categorize dams is a function of location only and has nothing to do with their stability or probability of failure.

1.2.5 Ownership: Owens-Illinois Co., Big Island, Virginia.

1.2.6 Purpose: The dam is not currently being used, however, the owner is considering converting the dam to produce electricity for its own use. (See Report by Wiley and Wilson, Inc., Engineers, Appendix IV).

*Height of the dam is the difference in elevation between the crest of the dam and the streambed at the downstream toe of the dam.

1.2.7 Design and Construction History: No design or construction data is available on the Coleman Falls Dam. The dam was constructed about 1851 as part of a navigation system for the James River. Around 1900 improvements were made by installing hydro-mechanical turbines to cut wood chips for a paper mill. This operation was dismantled during World War II and the dam has been unused since then (see Appendix IV for additional information).

1.2.8 Normal Operational Procedures: Regulation of flow is automatic with water rising above the spillway, passing freely downstream.

1.3 Pertinent Data:

1.3.1 Drainage Area: The dam controls a drainage area of 3,138 square miles.

1.3.2 Discharge at Dam Site:

Maximum Flood - 150,000 c.f.s., (Hurricane Camille 8/20/69)
(See Paragraph 5.3)

Spillway
pool level at top of dam . . . . 97,760 c.f.s.

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

Table 1.1 DAM AND RESERVOIR DATA

		Reservoir			
			Capacity		
Item	Elevation feet m.s.l.	Area acres	Acre feet	Watershed inches	Length miles
Top of Dam	605	330	6,300	0.04	4.2 (a)
Spillway Crest	589	250	1,700	0.01	4.2
Streambed at the toe of dam	569±	--	--	--	--

(a) To Big Island Dam

SECTION 2

ENGINEERING DATA

2.1 Design: There is no design data available for the Coleman Falls Dam.

*2.1.1 Geologic Setting of the Dam Site: Coleman Falls Dam is located within the Valley and Ridge physiographic province. The underlying bedrock of the site is part of the Virginia Blue Ridge complex typified by plutonic gneiss and associated metamorphic rocks.

2.2 Construction: In accordance with a 1979 Report, (included in Appendix IV), by Wiley and Wilson, Inc., Lynchburg, Virginia, the original project "consisted of a log crib and stone masonry dam, together with a lock for passage of canal boats".

2.3 Evaluation: Detailed evaluations of design and construction data are not possible or necessary since this dam has been in operation for almost 140 years with no record of serious problems.

*Information provided by Law Engineering Associates of Virginia.

SECTION 3

VISUAL INSPECTION

3.1 Findings:

3.1.1 General: The results of the 12 July 1979 inspection are recorded in Appendix III. At the time of the inspection the pool elevation was at 589.5 feet m.s.l. which is 0.5 feet above the normal. A report by Wiley and Wilson Engineers, Lynchburg, Virginia, which was performed in January 1979 is included in Appendix IV. The ground around the dam was heavily wooded with steep, rocky slopes (see photographs, Appendix II.)

3.1.2 Dam: The dam appears to be in good condition. A crack and several missing stones were noticed in the dam about 65 feet from the remains of the turbine building where the dam makes a 90° turn. The seepage through this crack is significant (approximately 5 gpm), however, due to its inaccessibility no measurement of flow was made (see Photograph No. 2, Appendix II.)

3.1.3 Appurtenant Structures: The remains of the old turbine building are located adjacent to the right abutment. Water is seeping through the headgate openings into the turbine pits, however, there is no apparent seepage around the dam near the building. There is no means, at present, of operating these gates.

3.1.4 Spillway: The Spillway is a masonry structure and appears to be in good condition except as noted in 3.1.2 above.

3.1.5 Instrumentation: There is no instrumentation on this dam.

3.1.6 Reservoir Area: The surrounding area is wooded and the reservoir is contained in the natural bed of the river.

3.1.7 Downstream channel: The downstream channel is the natural riverbed. The banks are wooded with steep slopes.

3.2 Evaluation: The dam appears to be in good condition with the notable exception of the crack and missing stones in the spillway. It is recommended that the owner monitor the leakage as part of his regular maintenance program and prior to converting the dam for hydroelectric use, the owner should initiate a more thorough inspection to insure that no other significant deterioration has occured.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure: The normal pool elevation is 589.0 which is the spillway crest. Regulation of flow is automatic as water rises above the spillway crest and passes freely downstream. The dam is not currently being used, however, plans for converting it to produce electricity are being considered. There is no means, at the present to regulate the level of the reservoir except through the spillway. The gates which allow water to flow into the turbine pits are not operational although they are partially opened.

4.2 Maintenance: There is no maintenance program established for the Coleman Falls Dam.

4.3 Warning System: There is, at present, no warning system for the dam.

4.4 Evaluation: The dam, in its recent history, has not required an extensive operation and maintenance procedure. However, a regular maintenance schedule and operational procedure should be initiated by the owner as part of his program to use the dam as a hydro-electric plant.

SECTION 5

HYDRAULIC/HYDROLOGIC DATA

5.1 Design: None were available.

5.2 Hydrologic Records: Hydrologic records are available from the gaging station at Holcomb Rock approximately 3 miles downstream.

5.3 Flood Experience: The dam has experienced numerous severe floods and ice conditions on the river such as that of March 1936 when a flow of 115,000 c.f.s. was recorded at Holcomb Rock and water rose to elevation 606.0 feet m.s.l. at the dam based on high water marks by the Corps of Engineers. The Camille Flood, which is the highest on record, occured August 20, 1969. The Holcomb Rock Station recorded a maximum discharge, 150,000 c.f.s., gage height, 35.5 feet, from rating curve extended above 73,000 c.f.s. Two additional floods occured in 1972.

5.4 Flood Potential: The peak flood discharges of PMF and 1/2 PMF were developed and furnished by the Corps of Engineers.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1

Water flows past the dam over the spillway automatically in the event water in the reservoir rises above 589.0.

The Corps of Engineers concluded that "The storage capacity in the reservoirs is so small compared to the volume of the flood hydrographs that no computable reduction in discharge would be made. Therefore, routing through either upstream reservoirs or through the reservoir of the dam being studied was not necessary. Therefore, the outflow will equal the inflow and a maximum elevation reached in a particular flood can be determined by applying the peak flow rate to the elevation - discharge relation for the dam."

5.6 Overtopping Potential: The probable rise of the reservoir and other pertinent information on reservoir performance is shown in the following table.

Table 5.1 RESERVOIR PERFORMANCE

Item	Normal Flow	March 1936	Hydrograph 1/2 PMF	PMF (a)
Peak Flow , c.f.s.				
Inflow	1,800	115,000	355,000	710,000
Outflow	--	--	355,000	710,000
Maximum elevation feet, m.s.l.	589.0	606.0(c)	624.8	644.6
Spillway (Elevation 589.0)				
Depth of flow, feet			35.8	55.6
Velocity, f.p.s. (b)			19.0	23.7
Non-overflow section (elevation 605.0)				
Depth of flow, feet			19.8	39.6
Velocity, f.p.s. (b)			19.0	23.7
Tailwater elevation, feet, f.p.s. (b)	572±	598.2±	617±	639±

(a) The PMF is an estimate of flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region

(b) Average velocity

(c) Based on high water marks established by the Corps of Engineers.

5.7 Reservoir Emptying Potential: There are no facilities available for dewatering the reservoir.

5.8 Evaluation: Based on size (intermediate) and hazard (significant) classifications, the recommended Spillway Design Flood is 1/2 PMF to PMF. Because of the risk involved in this project, the 1/2 PMF has been selected as the Spillway Design Flood. The spillway will pass 14% of the PMF without overtopping the dam. The SDF will overtop the dam by a maximum of 19.8 feet with an average velocity of 19.0 fps.

SECTION 6

STRUCTURAL STABILITY

6.1 Foundation and Abutments: There are no previous reports detailing the geology of the area or the stability of the dam. The underlying bedrock at the site is part of the Virginia Blue Ridge complex typified by plutonic gneiss and associated metamorphic rocks. The left abutment abuts an almost vertical cliff and was not inspected because of its inaccessibility. There was no noticeable deterioration or seepage at the right abutment.

6.2 Stability: The lack of information on the geometry of the dam made it difficult to accurately assess its stability. No known previous stability analyses have been performed on the dam.

6.3 Evaluation: Despite the lack of data, the dam seems to be stable. It has been functional for almost 140 years and the deterioration appears to be minimal. However, it is recommended that the owner, prior to converting the dam, initiate a more detailed inspection, and monitor the leakage and missing rocks to insure the continued stability of the dam.

SECTION 7

ASSESSMENT AND REMEDIAL MEASURES/RECOMMENDATIONS

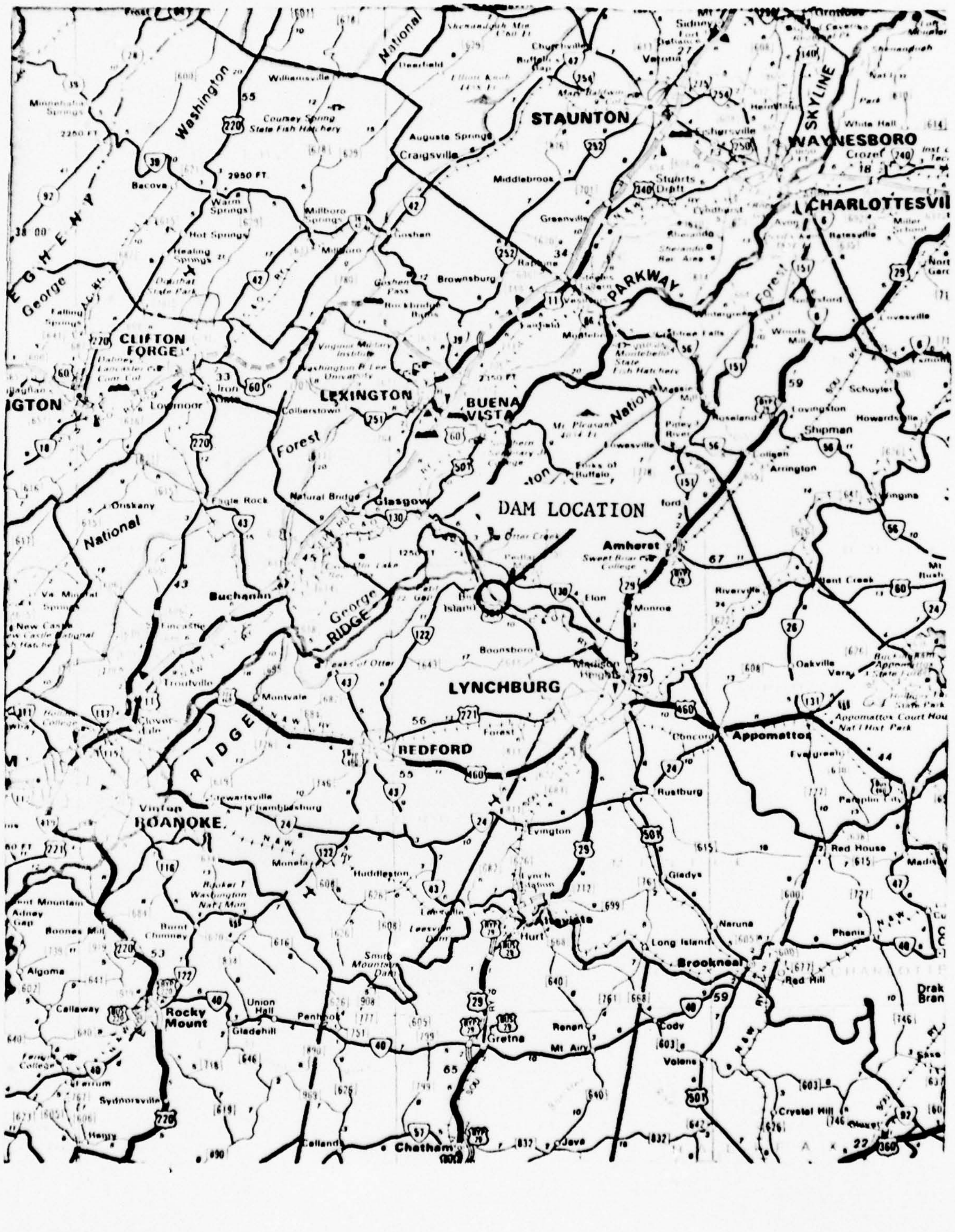
7.1 Dam Assessment: The data available is inadequate to evaluate the design and construction of the dam, however, the long history of the dam and the visual inspection indicate that it was well constructed. The visual inspection indicated some discrepencies which should be corrected prior to converting the dam for hydro-electric use, however, much of the dam was not inspected due to inaccessability and a more detailed inspection should be conducted.

The spillway will pass only 14% of the PMF without overtopping the dam. The SDF (1/2 PMF) will overtop the dam by a maximum of 19.8 feet with an average velocity of 19.0 f.p.s. The spillway is therefore adjudged inadequate. Overall, the dam is in good condition and there is no immediate need for remedial measures. It is basically a "run of the river" dam with a relatively small amount of storage water between head-water and tailwater elevations.

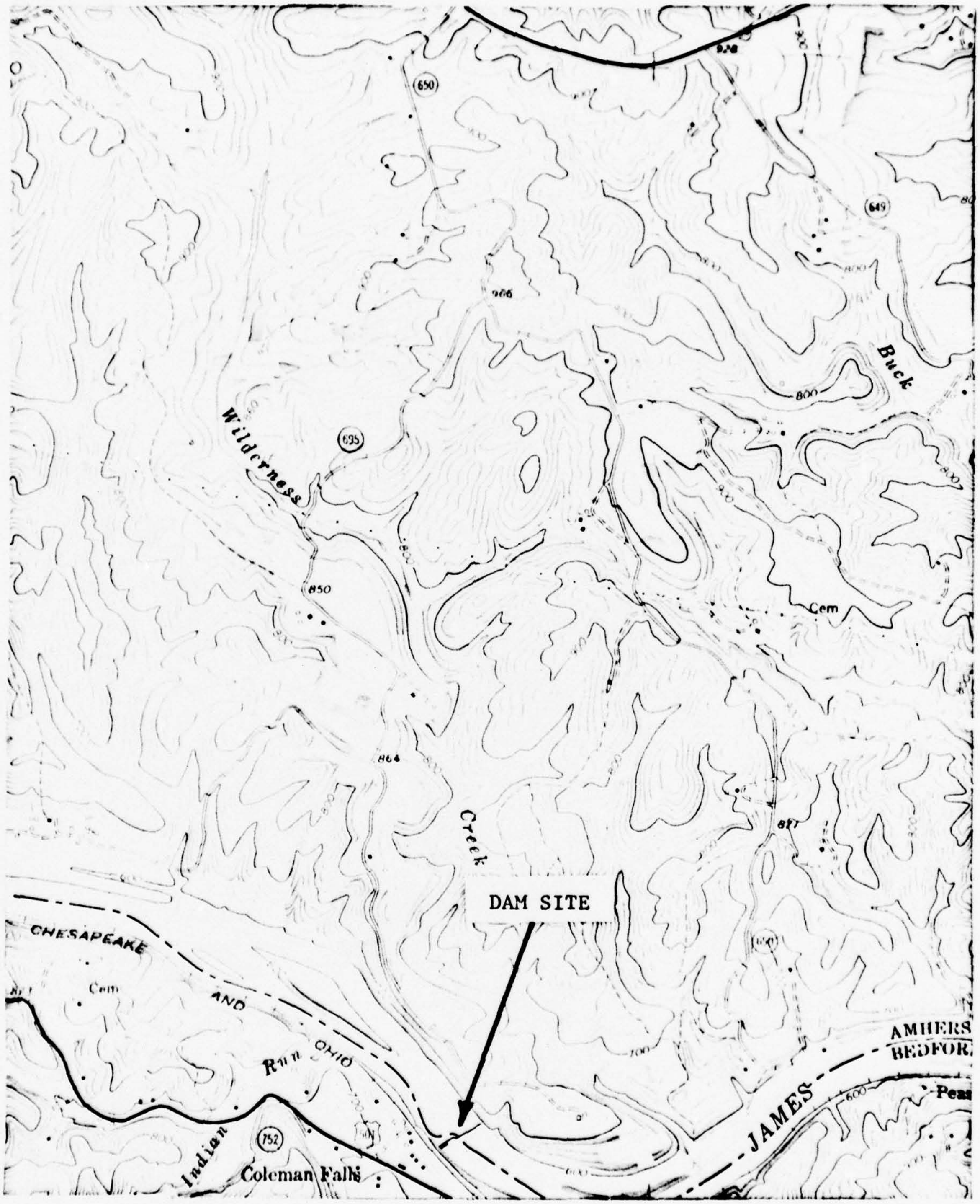
7.2 Recommended Remedial Measures: The inspection revealed some seepage and missing rocks which should be monitored as part of the regular maintenance program. It is recommended that the owner perform a more detailed inspection to insure that no other significant deficiencies exist before converting the dam to hydroelectric use.

APPENDIX I

MAPS AND DRAWINGS



REGIONAL MAP
COLEMAN FALLS DAM



BIG ISLAND, VA.

SE/4 BUENA VISTA 15' QUADRANGLE

N3730—W7915/7.5

1965

AMS 5159 III SE—SERIES V834

SCALE: 1" + 2000'

10' Contours

MN GN

4½° 80 MILS 1°02' 18 MILS

UTM GRID AND 1965 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

VICINITY MAP

COLEMAN FALLS DAM

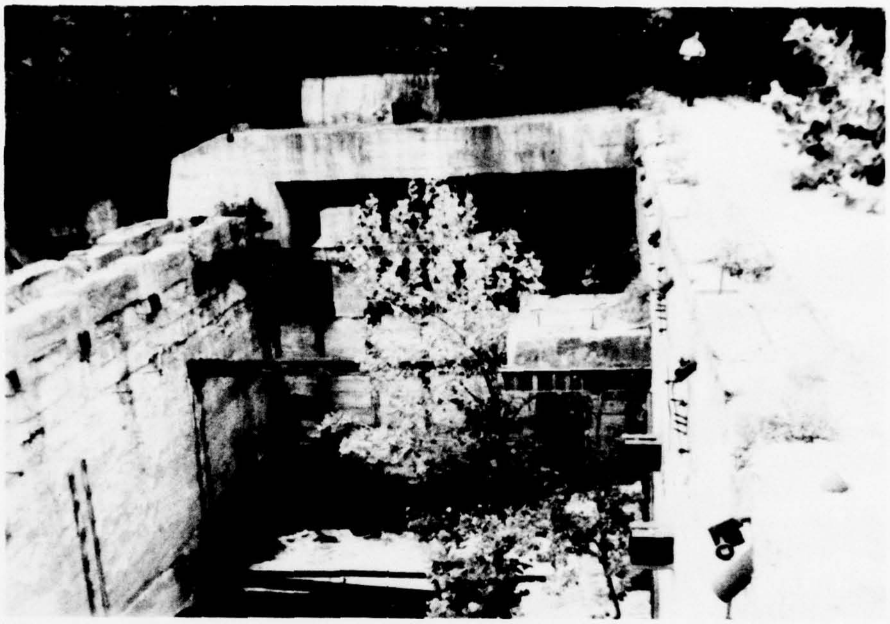
APPENDIX II

PHOTOGRAPHS

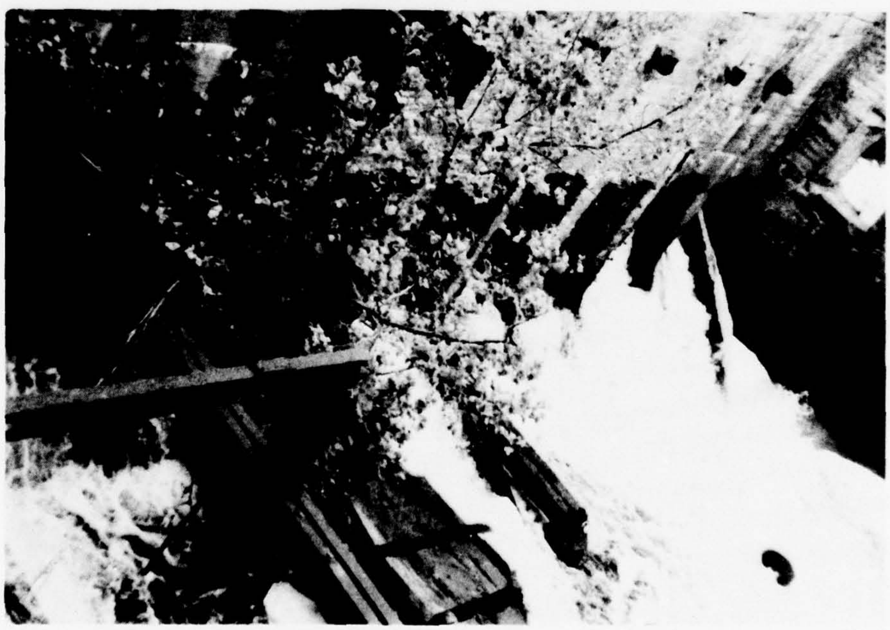
COLEMAN FALLS DAM

PHOTOGRAPH NO. 1
Spillway

PHOTOGRAPH NO. 2
Left Abutment



PHOTOGRAPH NO. 3
Old Mill Structure



PHOTOGRAPH NO. 4
Water Flow Through Mill Structure

PHOTOGRAPH NO. 5
Outlets from Mill Structure

PHOTOGRAPH NO. 6
Downstream

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Coleman Falls Dam County Amherst State Virginia Coordinates Lat. 3730.1 Long. 7918.0

Date(s) Inspection 7/12/79 Weather Showers Temperature 78°F

Pool Elevation at Time of Inspection 589.5 M.S.L. Tailwater at Time of Inspection 572 M.S.L.

Inspection Personnel:

Mr. R. Bryant , Owners representative Hugh Gildea S.W.C.B.

Tan Young , DMM&A

Bert Blake , Law Engineering

Paul Seiler DMM&A Recorder

~~CONCRETE~~/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEEPAGE OR LEAKAGE	Seepage at corner where rocks are missing. , 65 feet from right abutment.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	No apparent misalignment.	
DRAINS	N/A	
WATER PASSAGES		
FOUNDATION	Unknown.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRAKCS CONCRETE SURFACES	Some of the stone had been knocked off the crest of the dam and there was deterioration of the masonry at the corner formed by the dogleg in the dam at the right end.	
STRUCTURAL CRACKING	No serious cracking.	
VERTICAL AND HORIZONTAL ALIGNMENT	No misalignment	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Entire length of dam is ungated. Spillway at uniform crest elevation.	
APPROACH CHANNEL	Natural river bed.	
DISCHARGE CHANNEL	Natural river bed, approximately 700 feet wide with steep rocky slopes. Trees line the banks of the river-bed.	
BRIDGE AND PIERS	None	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Natural river bed. Steep, rocky slopes with heavy undergrowth of trees and underbursh.	
SEDIMENTATION	Unknown.	

DOWNSTREAM CHANNEL

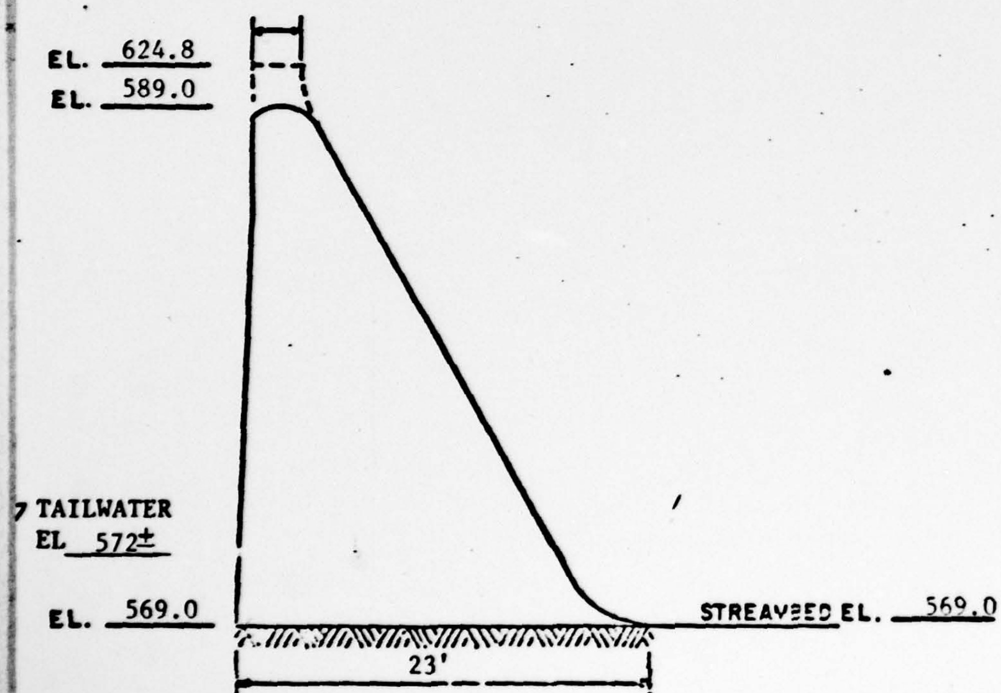
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No debris or other obstruction was observed in the vicinity of the dam.	
SLOPES	Natural river banks with steep rocky, treed slopes.	
APPROXIMATE NO. OF HOMES AND POPULATION	6 homes and 20 people within 3 miles downstream within the flood plain of the SDF.	

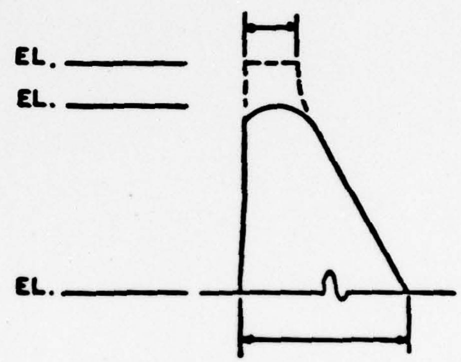
GRAVITY DAM DESIGN
STABILITY ANALYSIS

COLEMAN FALLS DAM

ANALYSIS DONE ON XX FULL SECTION ___ PARTIAL SECTION
LOCATION OF SECTION CENTER OF SPILLWAY
ANALYSIS PREPARED BY ______

LOADING CASE	ELEV. HEAD WATER	ELEV. TAIL WATER	ΣV	ΣH	ΣH/ΣV	LOCATION RESULTANT FROM TOE	% BASE IN COMPRESSION	FACTOR SAFETY SLIDING	FOUNDATION PRESSURE	
									TOE	HEEL
NORMAL POOL	589.0	572.0	33.3^k	12.2^k	0.37	7.9'			2.8^{ksf}	0.1^{ksf}
1/2 PMF	624.8	617.0	25.6^k	25.7^k	1.0	7.7'			2.2	0





PARTIAL SECTION

THIS ANALYSIS IS BASED ON THE ASSUMED GEOMETRIC CONFIGULATION SINCE NO DRAWINGS WERE AVAILABLE TO VERIFY THE DIMENSIONS OF THE DAM.

APPENDIX IV

PARTIAL REPORT
WILEY & WILSON, INC.
1979

FILE 90115-12

SPILLWAY CAPACITY HEAD CONDITIONS

JAMES RIVER DAMS

OWENS-ILLINOIS CO.

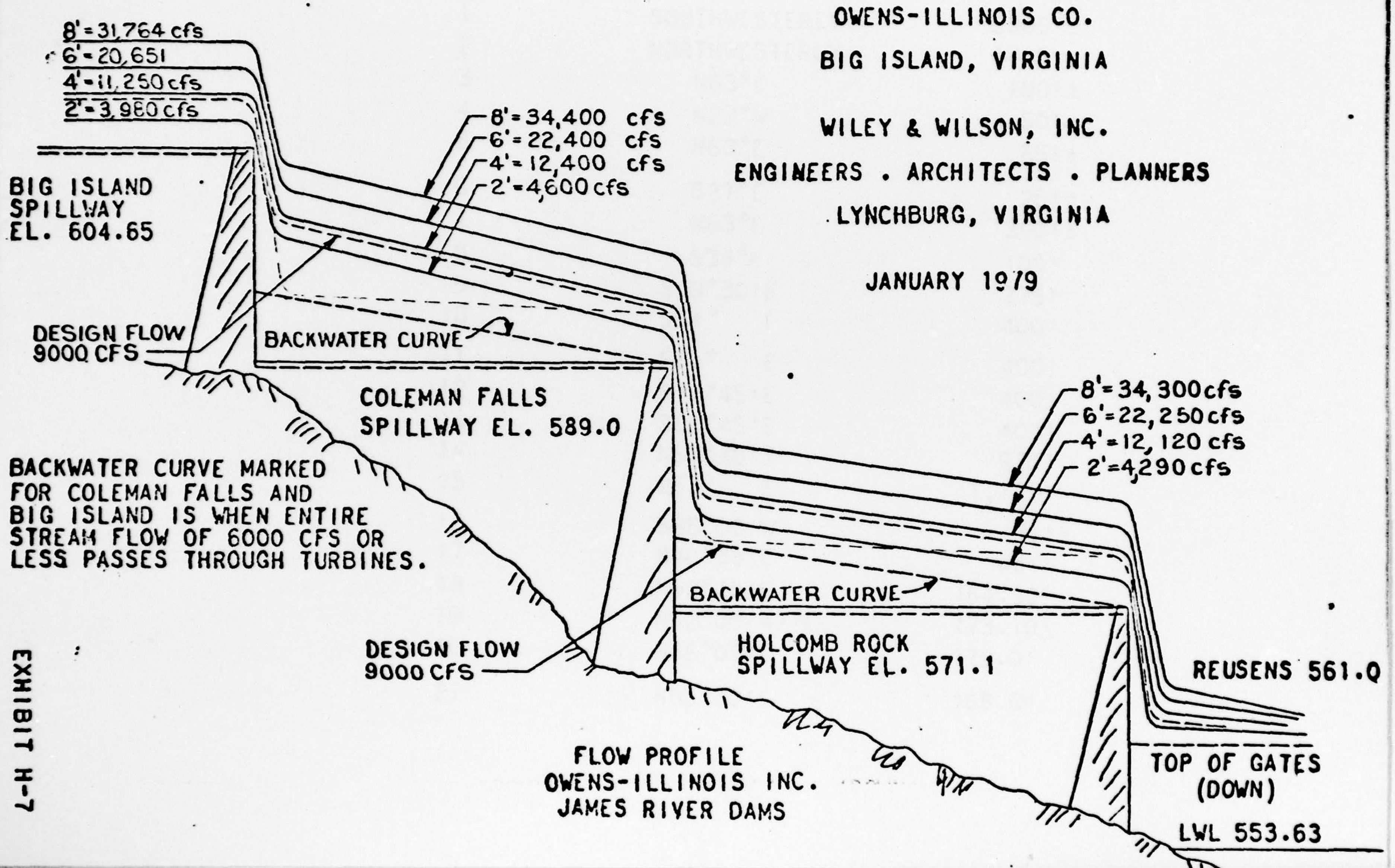
BIG ISLAND, VIRGINIA

WILEY & WILSON, INC.

ENGINEERS . ARCHITECTS . PLANNERS

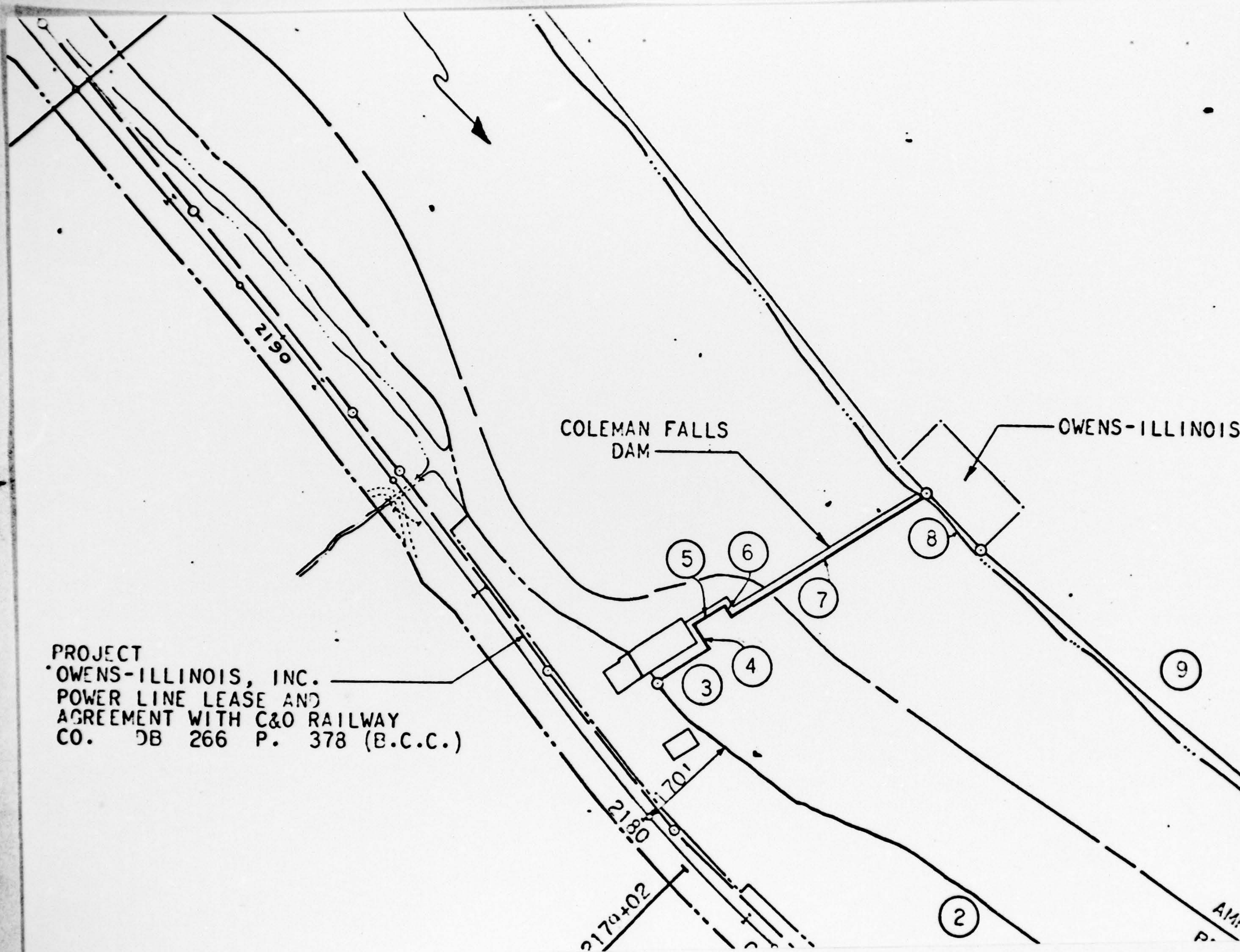
LYNCHBURG, VIRGINIA

JANUARY 1979



FLOW PROFILE
OWENS-ILLINOIS INC.
JAMES RIVER DAMS

EXHIBIT H-7


COLEMAN FALLS DAM
OWENS-ILLINOIS,
PROJECT
OWENS-ILLINOIS, INC.
POWER LINE LEASE AND
AGREEMENT WITH C&O RAILWAY
CO. DB 266 P. 378 (B.C.C.)
2190
2180
2170+02
170'
2
3
4
5
6
7
8
9

THE REPORT

HISTORY OF EXISTING FACILITY

The existing dam was completed and placed in service as a navigation facility about 1851 by the James River and Kanawha Canal Company as one of a series of locks and dams to connect the Virginia seaboard through the James River with the Kanawha River across the Blue Ridge and Alleghany Mountains on into the Ohio and Mississippi Rivers. The original project consisted of a log crib and stone masonry dam, together with a lock for the passage of canal boats. This structure and its purpose was similar to those at the Big Island and Holcomb Rock operations as well as two additional dams in the City of Lynchburg and at similar sites above Big Island where the City of Bedford and Virginia Electric and Power Company operate hydroelectric plants.

This dam has weathered numerous severe floods and ice conditions on the river such as that of March 1936. The Camille Flood, which is the highest on record, occurred August 19-20, 1969. Two additional severe floods occurred in 1972. The crest of the dam remains unbroken which is quite remarkable for stone masonry without maintenance through many years. About 1900 the Marcuse interests which developed and owned the Bedford Pulp & Paper Company, forerunner of your Big Island operations, made improvements to the Bedford end of the Coleman Falls Dam by installing "hydro-mechanical" turbines for cutting wood chips to be used in the Big Island Paper Mill. According to drawings dated 1909, 1911, 1914, and 1921 by S. Morgan Smith Company, that company furnished hydroelectric turbines for installation in the facility. This electric service was used to run the chippers for the machines cutting the wood chips shipped upstream in railroad box cars to the Big Island plant. Information indicates that during World War II, the operation at Coleman Falls was dismantled and all exposed machinery and equipment was salvaged in one manner or another. By 1950, all of the buildings were destroyed and the debris remains scattered downstream of the power house and below the floor level of the generator room.

Some water escapes through the headgate openings into the turbine pits but there is no evidence of water escaping around the end of the dam in the vicinity of the old structure. The Amherst County end of the dam is anchored in a rock cliff. The spillway length is 462.88 feet.

There is adequate real estate available at the site for the operations required in the improvements to the Coleman Falls station. Legal information indicated that Owens-Illinois has the necessary water rights to make the proposed development.

It appears from records that the water rights have passed down to Owens-Illinois at the Coleman Falls Dam and canal by means of encouragement from the Commonwealth of Virginia for the development and use of the river flow for navigation and power. The use of this water for the generation of hydroelectric energy is the use of a clean, renewable resource free of any form of air pollution, water pollution, or deterioration of quantity or quality of the flowing river and therefore ideally meets the purposes indicated by the Commonwealth of Virginia for the use of water in this particular location.

PROPOSED IMPROVEMENTS

The proposed improvements consist of clearing out the old turbine pits, walls, floors, and construction debris and installing four low head tube type turbine generator units. These units would each have a capacity of 1,768 kilowatts at maximum head and 1,100 kilowatts at the estimated low head of approximately 11 feet. The maximum available head is approximately 16.7 feet less the head loss at the entrance and through the trash racks and penstocks. The improvements would include excavation and removal of accumulated silt and debris in the vicinity of the intake and protection of the intake with sheet piling to control bank erosion and the flow into a trash rack ahead of the penstocks. The trash racks would be protected by a log boom to divert floating debris to the spillway. Steel trash racks would be equipped with trash rake and hoist. A trash cart would remove the collected debris from the racks to a discharge point below the spillway. A new reinforced concrete intake entrance to the penstocks would be required.

The entire power house structure would be of reinforced concrete to withstand floods equal to a little in excess of the Camille Flood. This means that the power house would in effect be a concrete vault on the top of which would be located the breaker and control panels in a concrete and masonry weatherproof room accessible from the exterior of the structure. The roof of the structure would be of steel girders and a poured concrete deck. It appears advisable that a 40 ton bridge crane be provided for handling and placing the equipment as the heaviest pieces would weigh 40,000 to 65,000 pounds.

The water entrance to the turbines would be through concrete penstocks fitted with stop log grooves and headgates equipped with electric hoist. It would be necessary to leave an opening in the railroad side of the building through which to deliver the turbine generator sections and other equipment. After installations are complete, the opening would be closed with reinforced concrete conforming to the remainder of the structure, leaving only a bulkhead access door in the upper part of the wall for personnel attending the station. Some excavation will be required for the accommodation of the power house structure and for the tail race area.

The surfaces subject to erosion would require riprap or sheet piling to eliminate scour.

In floods of the magnitude of the 1972 and the Camille flood, water would overtop the dike between the power house and the railroad and for this reason this area would require some paving and riprap protection to maintain suitable access under normal conditions. Access to the plant would have to be from U.S. Route 501 with a grade crossing and roadway parallel with the railroad for a short distance to the limited space available for a staging area adjacent to the power house. Construction operation of the project would be maintained in a dewatered cofferdam area upstream and downstream. The entire structure would be anchored into the rock foundation which is expected to be of satisfactory quality to provide suitable anchorage and to take the scour downstream resulting from the turbine discharge. All excavated material and existing construction debris and demolition material can be used to good advantage in stabilizing and landscaping the railroad side of the structure.

The exact conditions of the existing structure cannot be obtained without inspection by scuba diving by experienced personnel in such work. It is anticipated that some of the original crib construction would be encountered in the upstream side of the dam. The canal records indicate that the dam was constructed of log cribs anchored to the foundation rock and these cribs filled with stone, then the entire upstream slope covered with layers of heavy timbers. Based on inspection of other work where the material has been exposed, this timber would probably be of white oak or heart pine. This is similar to the upstream face of the Big Island Dam. Records from the canal company reports indicate that the structure was further protected by a heavy downstream masonry wall and cut stone caps to provide for the spillway. The adequacy of this work is indicated by the fact that the structure has been in existence for more than 125 years with little or no maintenance.

The generator output conductors would be carried through the station vault roof into the breaker room above where all switching, controls, instruments, gauges, and local supervisory equipment would be located together with the station power panel. The conductors would be carried from the roof of this breaker room to the oil circuit breakers at the connection to the transformer station from which the energy would be delivered to the connection on the transmission line to Big Island. It would be advisable to place the transformer on a base approximately 5 feet high to raise connections above normal flood water in the event floods cover the area between the generating station and the railroad embankment.

HIGHER HEAD OPERATION AT COLEMAN FALLS

Previous studies made by William C. Whitner & Company, Inc., for Loeb and Shaw, Inc., of New York in 1931 and by Wiley & Wilson in 1950 considered raising the Coleman Falls Dam

by 3 feet to use the difference in head between the normal stream level at Big Island and the Coleman Falls Spillway. Also the earlier report considered raising the dam to elevation 601 from elevation 589. This would flood out substantially the available head at Big Island which has a spillway elevation of 604.65. These considerations had some advantage at the time of these past reports but are not considered practical at the present time. The available property at Big Island has been utilized to the fullest extent and even downstream the river terrace has been graded for impoundments for acres of settling and aeration basins for wastewater treatment from the paper mill. This developed area would have been partially flooded by the increased height of the dam to elevation 601. The combined head and output of the presently proposed development of Coleman Falls together with that available from Big Island is substantially equal to the higher head improvements which could have been made at Coleman Falls except for perhaps providing about 1 to 2 hours additional peaking capacity from drawdown of the storage from the larger reservoir under favorable conditions. With the operation of Big Island, Coleman Falls, and Holcomb Rock under the control of Owens-Illinois, Inc., maximum advantage of streamflow can be obtained by the development at Coleman Falls without the expenditure of raising the Coleman Falls Dam. Such operation can be maintained and controlled by supervisory equipment.

The other point which may be considered is the addition of a fifth turbine generator unit at Coleman Falls which under favorable conditions could produce approximately an additional 2 million kilowatt hours per year and serve as a standby at other times.

As low flows are likely to occur sometime during the months of August, September, and October and possibly November, maintenance could be scheduled during this period of the year and the expenditure for a fifth wheel could be eliminated.

STREAMFLOW – HYDROLOGY

The flow at Coleman Falls is based on records of flow of the James River projected from the official gauging station at Holcomb Rock approximately 3 miles downstream. The average flow is estimated to be 3,415 cfs from a drainage area of 3,138 square miles. The flow, of course, varies more or less depending on the average yearly weather conditions. Furthermore, daily fluctuations in the streamflow vary widely and seasonal drought conditions such as existed during August, September, and October of 1978 reduced this flow. Yet, overall the 1978 rainfall of approximately 45 inches was about 6 inches above normal for the area. A streamflow duration curve is shown on Exhibit H-1 based on streamflow records since 1927. Corresponding conditions of flood will average out to approximately the established record of flow. Based on this flow and considering headwater and tailwater conditions, it is estimated

that the equipment proposed would yield approximately 26 million kilowatts per year, and generally provide for a kilowatt demand of approximately 5,000 to 6,500 kilowatts under average conditions, but of course, somewhat less under high floods and drought conditions. The lowest flow of record occurred briefly during the extended drought of 1931-33. The minimum flow of record of the river projected to this point is approximately 275 cfs but with the operation of the Gathright Dam, which forms Lake Moomaw on the Jackson River on the headwater of the James River above Covington, it is anticipated that the minimum flow will be approximately 500 cfs, equivalent to about 530 kilowatts which would be a very rare event of a few hours. Exhibit H-1 is a Streamflow Duration Curve for the gaging station at Holcomb Rock but which also is applicable to Coleman Falls and Big Island.

The Gathright Dam, under the direction of the Corps of Engineers, has been constructed for flood protection and low water supplement. It is estimated that approximately 3 feet or more of flood crest can be reduced at Coleman Falls by floodwater storage in the Gathright Reservoir and that this water will be released according to the downstream requirements and capabilities for handling releases. This condition therefore should be of benefit to power generation at the Coleman Falls Dam, both under low flow conditions and flooding.

It is proposed that the station be operated by supervisory control from a central station at the Big Island plant. It is also proposed that the automatic supervisory controls be such that all water available be passed through the turbines up to the limit of their capacity and that water be prevented from wasting over the dam if it can be passed through the turbines. So long as there is approximately 6 feet of head available during flood conditions, the turbine generation units should be able to maintain speed to generate electricity. It may be advisable at times that settings be such that water can be drawn down for approximately 1 foot for perhaps 30 minutes or as long as water is available to offset peak demands on the APCO supply to the Big Island mill.

In the event that improvements are made at Coleman Falls and Big Island, the drawdown of approximately 1 foot in Coleman Falls may be coordinated with the release of flows from Big Island, the City of Bedford Hydroelectric Station at Major just above the Big Island station, and the VEPCO operated Cushaw Station at U.S. Route 501 and State Route 130. The 7,500 kilowatt VEPCO station is generally operated as a peak facility unless higher flows permit full-time generation. The discharge of the Cushaw and Bedford City stations should be used by both Big Island and Coleman Falls stations to best advantage by the operation of a supervisory control system.

With possible improvements to the Holcomb Rock station, storm flows of 7,000 to 9,000 cfs can possibly be passed through the turbines of Big Island, Coleman Falls, and Holcomb Rock

to the best advantages and thus prevent a high backwater curve at Coleman Falls and Big Island. This would provide for more efficient operation of these two stations which would be substantially under the control of Owens-Illinois.

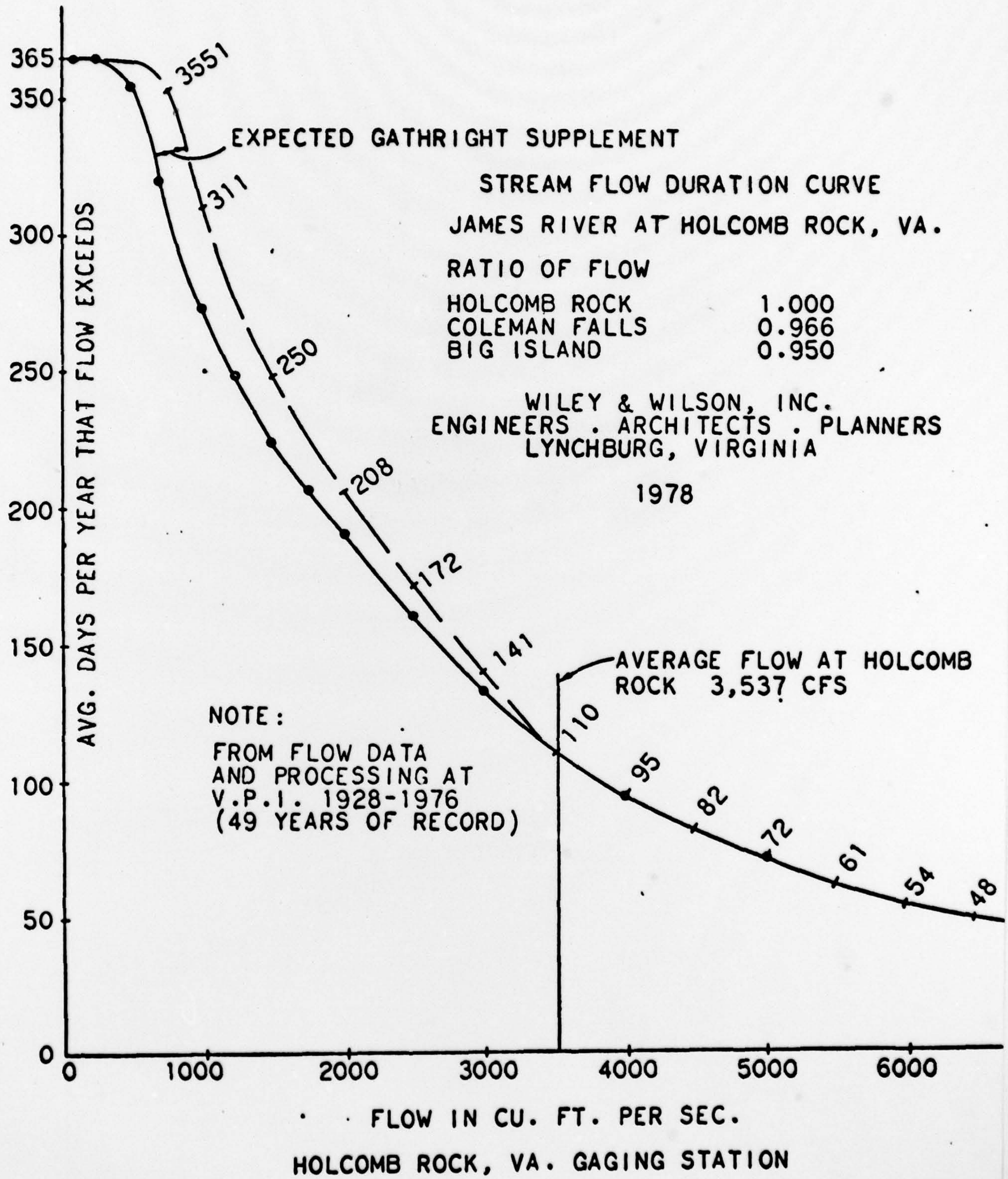
ELECTRICAL SYSTEM

A transmission line operating between the Holcomb Rock Hydroelectric station and the Big Island substation at the paper mill passes near the Coleman Falls station site. It is proposed that this transmission line be reconditioned to carry the load of the Coleman Falls station. At present, this line is a 3 conductor, 13,800 volt line, carried on wooden poles. By increasing the voltage to 34,000 and changing the insulators to carry this voltage, the conductors would have the capacity for the additional load to be made available from the Coleman Falls station. It is proposed that generation be at 2,300 volts and connected by breakers to a substation transformer bank to the transmission line for delivery of energy to the point at Big Island where Appalachian Power and the Holcomb Rock power join to serve the paper mill.

The introduction of the Coleman Falls load and high voltage to the transmission line from Coleman Falls to Big Island would impose the same load on the remainder of the line back to Holcomb Rock and require a change in the insulators on this portion of the line. A new transformer would be required at Holcomb Rock for the existing capacity of 1,875 kilowatts at Holcomb Rock, but which should be sized to take the additional load of new units if found desirable at Holcomb Rock Station No. 2.

OWENS-ILLINOIS, INC.
BIG ISLAND, VIRGINIA
PAPER MILL

EXHIBIT H-1



APPENDIX V

REFERENCES

LIST OF REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Department of the Army, Office of the Chief of Engineers, Washington, D.C. 20314.